JAPAN: Production and Imports of Food

An Analysis of the Welfare Cost of Protection

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JAPAN: PRODUCTION AND IMPORTS OF FOOD – AN ANALYSIS OF THE WELFARE COST OF PROTECTION. By Malcolm D. Bale and Bruce L. Greenshields, Foreign Demand and Competition Division, Economic Research Service, U.S. Department of Agriculture. Foreign Agricultural Economic Report No. 141.

ABSTRACT

The net social cost of Japan's 1985/86 production goals for eight major food items is calculated under the assumption that these goals existed in 1975/76. Based on the Corden model and actual 1975/76 production and consumption levels, it is estimated that the actual social cost of producing the eight commodities in 1975/76 was $387 million. Had the 1985/86 production goals been in effect, the net social cost in 1975/76 would have been nearly $8 billion.

Key words: Food consumption, grain, Japan, livestock products, projections, protection, soybeans, trade barriers.

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FOREWORD

This publication is one of a series of Foreign Market Studies being conducted by the Foreign Demand and Competition Division (FDCD), Economic Research Service, U.S. Department of Agriculture. These studies focus on countries that are major markets for U.S. agricultural exports and on countries whose farm exports compete with U.S. farm exports. The studies aim at providing a systematic and consistent basis for evaluating agricultural policies in these countries and projecting agricultural trade. They are being carried out either as in-house projects or by outside research institutions under contracts or cooperative research agreements. Francis S. Urban of FDCD is the project coordinator.

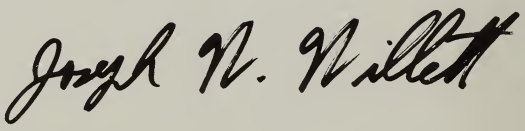
Because of recent trends toward rapidly changing situations in U.S. and world agricultural trade, the Economic Research Service has assigned the following objectives to the studies:

1. To identify and, to the extent possible, quantify factors within each country which affect, or may affect, changes in its agricultural trade, especially trade with the United States.

2. To improve the capability of the U.S. Department of Agriculture to project the volume and value of agricultural trade in the short and medium term.

3. To enable the U.S. Department of Agriculture to better analyze and test fluctuations occurring in agricultural trade in response to changing economic conditions and policy considerations.

The studies concentrate on, but are not confined to, commodities in the grains-oilseeds-livestock sector, which constitute the most important commodities in the world agricultural trade. These studies necessarily depend on the quality and quantity of available data. Hence, some of the studies contain mainly descriptive and qualitative analysis. However, most include quantitative analysis involving econometric models.



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Note: All measurements of weight, volume, and area are metric. Split years refer to Japan fiscal year (JFY), beginning in April of the first of the 2 split years – for instance, 1975/76 refers to April 1975-March 1976. Single years refer to calendar year (CY) – for instance, 1976 refers to January 1976-December 1976. Agricultural production indicated for any year is assumed to be available for consumption during that year. Social cost, social loss, welfare cost, and welfare loss are used synonymously. The exchange rate used throughout this report is 302 yen per U.S. dollar.

SUMMARY

Japan, the world's largest net importer of agricultural products and the single most important market for U.S. farm exports, plans to significantly increase domestic food production over the next decade to lessen its dependence on foreign suppliers. The Government's ambitious goals for 1985/86 are attainable, but only at a high cost to the Japanese society relative to the cost of importing food.

Because Japan is a small, heavily populated country with little arable land, there is no comparative advantage in agricultural production except for some fruits and vegetables. In 1976, the country imported $11 billion worth of farm products, with $4 billion worth coming from the United States.

Japan's agricultural sector is nevertheless heavily protected by a variety of trade barriers, and is heavily supported by input subsidies and support payments. Implementation of the 1985/86 production goals would mean even greater Government support to farmers and more stringent trade restrictions.

Based on the Corden model for calculating economic surpluses, this study estimates the social cost of meeting the production goals for eight food items of major importance in the Japanese diet: wheat, rice, soybeans, barley, dairy products, pork, poultry, and beef.

If the 1985/86 production goals for these items had existed in 1975/76, the net social cost would have been nearly $8 billion—equivalent to 2 percent of the 1975/76 GNP, or to one-third of each household's expenditures on the eight commodities and their products. This compares with an actual net social cost estimated to have been $387 million. The calculated net social costs are not simply transfer payments to agriculture from other sectors of the economy. Rather, they represent a real reduction in national income.

JAPAN: PRODUCTION AND IMPORTS OF FOOD — AN ANALYSIS OF THE WELFARE COST OF PROTECTION

by
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INTRODUCTION

Although Japan has a modern and highly developed agricultural industry, it is the world's largest net importer of agricultural products and the most important single-country market for U.S. agricultural exports. In 1976, Japan imported over $11 billion worth of agricultural products; nearly $4 billion worth were from the United States. The country's high degree of dependence on foreign food and the vulnerability of the economy to commodity price fluctuations which are beyond its control has become apparent to Japanese policymakers. As a result, Japan has decided to undertake an ambitious "Coordinated National Food Supply Program" in an attempt to increase domestic food production over the next decade.

Specific production goals to be achieved by 1985/86 have been published by the Japanese Ministry of Agriculture and Forestry (*10*).[3] Table 1 includes a summary of the production goals, along with estimated consumption and imports, for eight selected commodities: wheat, rice, soybeans, barley, dairy products, pork, poultry, and beef. As the table indicates, attempts are going to be made to expand production of all of these commodities except rice.

This will not be a simple task. Japan is a small, heavily populated country with little arable land. With the exception of some fruits and vegetables, there is no comparative advantage in producing agricultural products. Domestic agriculture is heavily protected from foreign competition by a variety of trade barriers, and is heavily supported by producer subsidies and support payments. Because of the inelastic supply function for most of Japan's agricultural output, product prices must rise considerably if an increase in production is to be attained. Consequently, there would be a substantial cost to the Japanese society in terms of meeting the 1985/86 production goals, rather than producing and importing amounts consistent with prevailing world commodity prices.

In this study, the net social cost incurred in the consumption and production of principal agricultural commodities is calculated for 1975/76, and then the marginal social cost of implementing the 1985/86 production

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[3] Italicized numbers in parentheses refer to literature listed in the references section at the end of this report.

Table 1 – Production, consumption, and imports of principal food commodities, Japan, selected years, 1955/56-1975/76, and estimated, 1985/86

Item	Wheat	Rice[1]	Soybeans[2]		Barley[3]		Dairy products[4]	Pork	Chicken	Beef
					1,000 metric tons					
Production:										
1955/56	1,468	12,385	507		2,408		1,031	86	33	134
1965/66	1,287	12,409	230		1,234		3,271	385	238	190
1975/76	241	13,165	126		221		5,010	891	756	327
1985/86[5]	553	12,110	427		890		7,680	1,325	914	508
Consumption:										
1955/56	3,618	11,275	1,235	(433)	3,307	(2,842)	1,147	86	33	135
1965/66	4,631	12,993	2,030	(523)	1,688	(1,023)	3,815	385	246	201
1975/76	5,578	11,964	3,502	(692)	2,195	(1,019)	6,125	1,058	781	407
1985/86[6]	5,899	12,110	5,007	(707)	2,502	(996)	8,142	1,335	915	625
Imports:										
1955/56	2,238	1,290	767		681		116	0	0	1
1965/66	3,532	1,052	1,847		512		506	0	8	11
1975/76	5,715	29	3,334		2,117		787	208	28	91
1985/86[7]	5,346	0	4,580		1,612		462	10	1	117

[1] Brown basis. [2] Numbers in parentheses exclude soybeans for crushing. [3] Numbers in parentheses exclude barley for feed. [4] In raw milk equivalent. [5] Japanese Government production goals. [6] Japanese Government consumption estimates. [7] Inferred from production goals and consumption estimates, assuming no change in stocks and no exports.

Source: Ministry of Agriculture and Forestry, *Food Balance Sheet,* Tokyo, Nov. 1976 (for actual data for 1955/56, 1965/66, and 1975/76). Ministry of Agriculture and Forestry, *Long-Term Prospect of Production and Demand of Agricultural Products* in Japan, Tokyo, Aug. 1975 (for data on production goals and consumption estimates for 1985/86).

goals is estimated. The study is divided into four sections. First, the theoretical basis for calculating the net social loss to an economy from price distortions is explained, and the rationale for the study is outlined. Second, supply and demand estimates by commodity are presented; these are used in the third section to calculate the net social loss. Finally, we present our conclusions.

THEORETICAL BASIS FOR THE ANALYSIS

The proposition that free trade is, from an economic point of view, more beneficial than protection is one of the most fundamental and widely accepted propositions in economic theory. It rests on two basic premises: the static argument that trade barriers distort the optimal allocation of national and world resources and so reduce output, and the dynamic argument that economic freedom stimulates competition, thus ensuring an environment beneficial to economic growth.

Quantification of the economic gain or loss resulting from alternative economic policies is clearly a legitimate scientific activity that practicing economists should present to policymakers. To quantify the impact of commercial policy options such as tariff levels, quantitative trade restrictions, and production and export subsidies, extensive use has been made of the twin constructs of consumers' and producers' surplus.[4]

Likewise, in this study the social cost of Japanese agricultural production and consumption is based on the traditional Marshallian concept of economic surplus. We use the Corden type model (*2*), which, as illustrated in figure 1, shows the partial equilibrium effects of a tariff and subsidy. At the free trade price, P_f, the country imports $Q_4 - Q_1$ of the commodity, where D and S are the domestic demand and supply curves, respectively. If a tariff of $P_t - P_f$ is imposed, imports will fall to $Q_3 - Q_2$. Using the concept of economic surplus, the welfare loss to consumers is given by P_tBFP_f, the welfare gain to producers by P_tAEP_f, and the gain in Government revenue by $ABDC$. Thus, the net social loss from the tariff is given by $AEC + BDF$.

The area bounded by AEC is known as the "producer deadweight cost" because it represents the welfare loss imposed by the distortion of production from the optimal pattern indicated by free market prices. The area of BDF is the "consumer deadweight cost" since it represents the welfare loss resulting from the distortion of consumption from the optimal pattern indicated by free market prices. The case of an export subsidy is illustrated in the upper portion of figure 1. If P_f' is the world price and an export subsidy of $P_t' - P_f'$ is imposed, then the net welfare cost (deadweight loss) is defined by the areas $HGJ + KLM$.

Various assumptions are implicit in the above framework. Since they are well documented elsewhere (*3*), we mention them only briefly:

1. In using partial equilibrium analysis, indirect effects, such as employment changes and compensating currency realignments, are neglected.

2. The terms of trade are assumed constant, and the small country assumption—that one country's behavior cannot affect world prices—is assumed to hold.

[4] For a survey see Currie *(3)*.

Effects of a tariff and subsidy

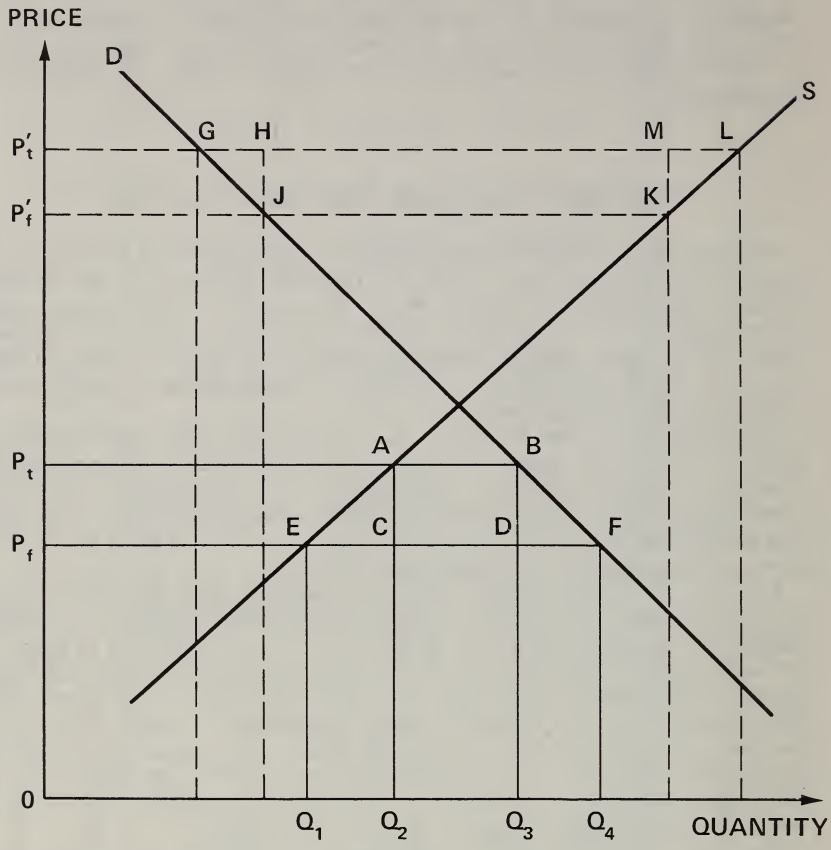

Figure 1

3. The marginal utility of money is constant with respect to prices.

4. Where necessary, it is assumed that marketing margins are constant.[5]

5. Full employment of resources is assumed.

In this study we begin by answering the question: What was the social loss to Japan of its level of agricultural protection in 1975/76? We then ask: If 1985/86 food production goals had been implemented in 1975/76, what

[5] Prices received by farmers are used in making the supply estimates. By so doing, the problem of overestimation of the social cost in production that occurs when wholesale prices are used is avoided. The consumption loss is the same whether calculated with wholesale or retail prices only if marketing margins are constant *(4)*.

would have been the marginal social loss to Japan of such a policy? To make this latter estimate, we assume that producer prices in 1975/76 were increased through Government supported prices and that consumer food prices were maintained at current real levels. Such assumptions are based on recent Japanese agricultural policy. Supported prices have been the principal means of stimulating agricultural production in Japan, although input subsidies have also been important.[6] The maintenance of certain consumer food prices at current levels in real terms has also been deemed important by the Japanese Government in order to achieve other macroeconomic goals. Consumer subsidies have been used on many basic food products in order to hold down food price increases. In some cases, the Japanese resale price of imported commodities has been below world prices, although usually domestic prices for most food products are considerably above levels prevailing in many other developed countries.

There are two reasons for calculating the cost of the 1985/86 production plan based on its hypothetical existence in 1975/76. First, if we assume it had been implemented in 1975/76, we do not have to project such variables as population, income, calorie intake, taste changes, and relative prices in 1985/86. Rather, we can use the known figures for 1975/76. Second, supply and demand curves based on recent data are more likely to reflect the respective economic agents' reaction to price change in 1975/76 than they are to reflect the same agents' reaction 10 years hence.

ESTIMATES OF DEMAND AND SUPPLY

Estimates of the demand and supply functions for the eight commodities examined appear in table 2.[7] The parameters are estimated using ordinary least squares regression analysis. Linear equations are specified throughout and each was estimated independently, but with the effects of substitution among certain commodities captured by the use of price ratios. The figures in parentheses below the estimated parameters are the "t" statistics. Other statistics shown are sample size (n), coefficient of multiple determination (R^2), coefficient of variation ($C.V.$), Durbin-Watson statistic (d), and partial real price and real income elasticities (ϵ). $C.V.$ is expressed as a percentage, and ϵ is measured at the means of the variables.

Demand is specified as a function of price and income. Population is implicit in the income variable under the assumption that in a market economy, population per se does not constitute effective demand. The price of the principal substitute and all other prices are incorporated into the demand functions using a price ratio of (a) own price to (b) substitute price to (c) all prices. The price variable thus reflects both a relative price and a real

[6] In making calculations of the net social loss in production engendered by support prices, we ignore the losses that may result from input subsidies. The reason for only considering the effect of support prices is that support prices are the principal means of subsidizing agricultural output. Also, the influence of input subsidies in their multifarious forms on the supply function is extremely difficult to calculate. Further, if the effect of input subsidies on the supply function is constant over all output prices, then the supply function will be moved to the right, parallel to the original supply function and the calculation of the net social loss will be unaffected.

[7] Data used in this section are annual. Regardless of sample size, 1975/76 or 1975 is the last observation in every sample. Consumption data are on a gross weight basis. Data sources are as follows: Consumption and production *(9)*, retail prices *(14)*, GNP and its price deflator *(5)*, producer prices and retail input prices *(11)*, and wholesale prices *(1)*.

Table 2 – Estimated demand and supply functions

Commodity	Equations	n	R^2	C.V.	d	$\varepsilon(P)$	$\varepsilon(I)$
Wheat	$Y_1 = 5016.48 - 813.410(X_1/X_2/X_3) + 12.2926(X_4/X_5)$ (18.63) (4.77) (6.32)	15	0.96	2	1.76	-0.16	0.15
	$Y_2 = 79022.4 + 1430.68(X_6/X_7/X_8/X_9)_{t-1} - 40.5533\ X_{10} - 660.325\ X_{11} + 622,133\ X_{12}$ (5.23) (5.44) (5.34) (4.07) (3.24)	22	0.91	15	1.39	1.61	
Rice	$Y_3 = 16563.8 - 1089.70(X_2/X_1/X_3) - 43.0688(X_4/X_5)$ (23.17) (3.86) (7.54)	15	0.89	2	1.83	-0.12	-0.21
	$Y_4 = -18.3433 + 1856.99(X_{13}/X_{14}/X_8/X_9)_{t-1} + 98.7797\ X_{10} - 2358.07\ X_{15}$ (4.24) (3.48) (4.49) (5.05)	24	0.77	6	1.52	0.16	
Soybeans	$Y_5 = 537.851 - 60.0182(X_{17}/X_1/X_3) + 1.69923(X_4/X_5)$ (4.63) (1.16) (2.10)	15	0.86	4	1.16	-0.14	0.18
	$Y_6 = 30892.8 + 99.2990(X_{14}/X_{13}/X_8/X_9)_{t-1} - 15.6541\ X_{10} - 50.8451\ X_{15} + 87.2884\ X_{12}$ (6.92) (2.94) (6.95) (2.41) (3.31)	24	0.95	11	1.57	0.46	
Barley	$Y_7 = 1230.45 - 259.416(X_{17}/X_{18}/X_{19}) - 8.45516(X_4/X_5)$ (11.87) (2.97) (14.53)	13	0.95	8	1.82	-0.51	-1.23
	$Y_8 = 916.815 - 0.651812(X_{20}/X_3) + 3.73795(X_4/X_5)$ (3.18) (3.10) (3.33)	11	0.97	5	1.40	-1.28	0.51
	$Y_9 = 223487 + 630.094(X_7/X_6/X_8/X_9)_{t-1} - 113.459\ X_{10} - 851.991\ X_{11} + 476.263\ X_{12}$ (16.69) (2.93) (16.87) (6.46) (3.08)	22	0.98	10	1.43	0.55	

Continued –

Table 2 – Estimated demand and supply functions – continued

Commodity	Equations	n	R^2	C.V.	d	$\epsilon(P)$	$\epsilon(I)$
Milk	$Y_{10} = 6847.78 - 168.349(X_{21}/X_3) + 41.9269(X_4/X_5)$ (4.08) (3.03) (15.32)	14	0.98	3	1.18	-1.00	0.55
	$Y_{11} = -83674.9 + 1964.39(X_{22}/X_{23})_t - 1403.03(X_{22}/X_{23})_{t-1} + 2038.08(X_{22}/X_{23})_{t-2} + 42.0772\ X_{10}$ (1.80) (3.18) (2.36) (3.16) (1.75)	10	0.96	2	1.67	0.43	
Pork	$Y_{12} = 504.819 - 469.074(X_{24}/X_{25}/X_3) + 9.87347(X_4/X_5)$ (4.29) (5.52) (16.86)	14	0.99	5	1.37	-0.76	0.97
	$Y_{13} = -86224.9 - 196.347(X_{26}/X_{27}/X_{28}/X_9)_t + 106.387(X_{26}/X_{27}/X_{28}/X_9)_{t-1} + 44.1560\ X_{10}$ (5.68) (2.54) (1.38) (5.75)	10	0.92	7	1.71	0.14	
Chicken	$Y_{14} = -104.793 - 114.437(X_{25}/X_{24}/X_3) + 10.1262(X_4/X_5)$ (1.06) (2.66) (12.38)	8	0.99	1	2.75	-0.15	1.33
	$Y_{15} = -165825 + 126.709(X_{27}/X_{26}/X_9)_t + 67.0063(X_{27}/X_{26}/X_{29}/X_9)_{t-1} + 84.3337\ X_{10}$ (7.13) (1.67) (0.89) (7.17)	10	0.99	4	1.84	0.12	
Beef	$Y_{16} = 286.964 - 140.939(X_{30}/X_{24}/X_3) + 2.82836(X_4/X_5)$ (6.56) (5.97) (11.56)	16	0.96	7	1.40	-0.80	0.66
	$Y_{17} = -28979.0 - 89.9772(X_{31}/X_{22}/X_9)_t + 156.679(X_{31}/X_{22}/X_9)_{t-3} + 14.7911\ X_{10}$ (2.64) (1.04) (0.71) (2.65)	10	0.72	15	1.92	0.66	

Endogenous variables (units = 1,000 metric tons):

Y_1 = Wheat consumption
Y_2 = Wheat production
Y_3 = Rice consumption
Y_4 = Rice production
Y_5 = Soybean consumption
Y_6 = Soybean production
Y_7 = Food barley consumption
Y_8 = Malting barley consumption
Y_9 = Barley production
Y_{10} = Dairy product consumption
Y_{11} = Milk production
Y_{12} = Pork consumption
Y_{13} = Pork production
Y_{14} = Chicken consumption
Y_{15} = Broiler production
Y_{16} = Beef consumption
Y_{17} = Beef production

Exogenous variables:

X_1 = Retail bread price, Tokyo, yen per kilogram
X_2 = Retail rice price, Tokyo, yen per kilogram
X_3 = Consumer price index, all Japan, 1970 = 1
X_4 = Gross national product (GNP), trillion yen
X_5 = Implicit GNP price deflator, 1970 = 1
X_6 = Producer wheat price index, 1970/71 = 1,000
X_7 = Producer barley price index, 1970/71 = 1,000
X_8 = Retail fertilizer price index, 1970/71 = 1
X_9 = Producer input price index, 1970/71 = 1
X_{10} = Time trend, 1950/51 = 1950, etc.
X_{11} = Dummy variable representing unusually low yields not directly attributable to included economic variables, zero when not applicable, one in 1963/64
X_{12} = Dummy variable representing the Government program to increase wheat, soybeans, and barley production, zero through 1973/74 and one thereafter
X_{13} = Producer rice price index, 1970/71 = 1,000
X_{14} = Producer soybean price index, 1970/71 = 1,000
X_{15} = Dummy variable representing unusually low yields not directly attributable to included economic variables, zero when not applicable, one in 1953/54, 1954/55, and 1971/72
X_{16} = Retail *miso* price, Tokyo, yen per kilogram
X_{17} = Wholesale barley price index, 1970 = 1,000
X_{18} = Wholesale wheat flour price index, 1970 = 1,000
X_{19} = Wholesale price index, 1970 = 1
X_{20} = Retail beer price index, Tokyo, 1970 = 1,000
X_{21} = Retail milk price, Tokyo, yen per 200 milliliters
X_{22} = Producer milk price index, 1970/71 = 1,000
X_{23} = Retail dairy cattle feed price index, 1970/71 = 1,000
X_{24} = Retail pork price index, Tokyo, 1970 = 1,000
X_{25} = Retail chicken price index, Tokyo, 1970 = 1,000
X_{26} = Producer swine price index, 1970/71 = 1,000
X_{27} = Producer broiler price index, 1970/71 = 1,000
X_{28} = Retail swine feed price index, 1970/71 = 1
X_{29} = Retail broiler feed price index, 1970/71 = 1
X_{30} = Retail beef price, Tokyo, yen per kilogram
X_{31} = Producer beef cattle price index, 1970/71 = 1

price. It is relative in the sense that it is expressed as a ratio of the own price to the principal substitute commodity price. It is real in the sense that the ratio is deflated by an index of all prices to remove the effects of inflation. For malting barley and milk, no principal substitute was identified.

Supply is generally specified as a function of price and trend. Prices of alternative commodities in production, principal inputs, and all inputs are incorporated into the supply functions by means of price ratios. Principal inputs apply to production of both the commodity under examination and any substitute commodity. The price ratio allows for the substitution effects of production of an alternative commodity, as well as for the general opportunity costs vis-a-vis all other uses of capital. For milk, no substitute commodity is identified. For beef cattle, no principal input is identified. Dummy variables are used to account for unusually low yields not directly attributable to price or trend, and to account for the Government program to increase crop production.

NET SOCIAL LOSS INCURRED IN CONSUMPTION AND PRODUCTION

For each commodity, we make two estimates of the net social loss incurred by Japanese Government intervention in food markets. The first estimate represents the costs of the 1975/76 price supports to farmers and the consumer subsidies that maintained commodity prices at other than their free world market levels. The second estimate calculates the social cost (in 1975/76) of the level of agricultural production planned for 1985/86.

Consider again figure 1, where domestic supply and demand curves for one commodity are shown for Japan.[8] The net social loss in consumption by maintaining the domestic price at other than the world price is given by:

$$NSL_C = 1/2\ (P_t - P_f)\ (Q_4 - Q_3) = BDF$$

where:

P_t = domestic price
P_f = world price
Q_3 = consumption at the domestic price
Q_4 = consumption at the world price

The net social loss in production by maintaining domestic producer prices at other than the world market price is given by:

$$NSL_p = 1/2\ (P_t - P_f)\ (Q_2 - Q_1) = AEC$$

where:

Q_1 = domestic production at the world price
Q_2 = domestic production at the domestic price

[8] Only two cases are portrayed, but the calculation of the total social loss to the economy holds for any situation where domestic prices are other than those obtaining in world markets. The distribution of the total social loss is not measured here, nor can there necessarily be any conclusions drawn about it from the data presented here.

The sum of the net social loss in production and consumption equals the total net social loss to the economy. The difference between the total loss for 1975/76 and 1985/86 represents the additional social loss of achieving the higher level of production.

Table 3 contains the prices that were used in determining the total *NSL* in 1975/76. The support prices required to bring forth the 1985/86 output goals were obtained from the supply equations, and are as follows:

Commodity	Yen per ton
Wheat	148,593
Rice	0[9]
Soybeans	1,603,312
Barley	267,393
Milk	184,589
Pork	5,425,112
Chicken	3,562,738
Beef	3,402,618

The estimated net social losses in consumption and production are displayed in table 4. Consumption losses for 1975/76 range from a high of 32 billion yen for dairy products to 415 million yen for soybeans, while production losses range from 17 billion yen for rice to 59 million yen for poultry. In general, the ranking of the total net social losses for 1975/76 corresponds to what we might expect. The protected livestock industries, except the relatively efficient poultry industry, and the rice industry incur the highest losses. The wheat and soybean industries incur the smallest losses, because wheat and soybeans are virtually all imported.

The effect of the 1985/86 production goals on social losses is dramatic. Net social costs in production would increase to 2.3 trillion yen (US$7.6 billion). Livestock products and soybeans are the major contributors, while the net social loss of the rice support program would decline under the future plan.[10] Overall, for the eight commodities analyzed here, net social losses are estimated to have been 117 billion yen in 1975/76, and would have been 2.4 trillion yen had the 1985/86 production goals been in effect.

Although we make no attempt to estimate the net social loss in the production and consumption of all food commodities in Japan, the eight commodities we have chosen represent (with some exceptions) the most important ones in terms of consumption. Omitted commodities where substantial social losses may occur are fruits and vegetables. Other food commodities are rather minor in importance in Japan and significant social losses are unlikely to result from price distortions for these commodities.

[9] Because of the inelastic price response measured from the limited range of data in our sample, there was no positive price that would satisfy the supply equation for the 1985/86 production goal.

[10] Probably not to zero as indicated in the table, however. See footnote 9 above.

Table 3 – Comparison of Japanese and world prices, selected food commodities, 1975/76

Commodity	Japanese price		World price	
	Producer[1]	Retail	Producer	Retail
	Yen per ton			
Wheat	112,000	[2]46,553	[3]56,179	[3]56,179
Rice	229,000	[4]189,880	[5]112,770	[5]112,770
Soybeans	145,417	[1]145,417	[6]90,144	[6]90,144
Barley	98,324	[7]34,933	[8]47,454	[8]47,454
Milk	91,300	[9]227,510	[10]66,070	[11]171,340
Pork	501,200	[12]1,550,000	[13]336,000	[14]1,071,000
Chicken	290,900	[15]990,000	[16]323,561	[17]789,174
Beef	865,800	[18]2,710,000	[19]667,975	[20]1,967,490

[1] Price received by producers in 1975/76 *(11)*.

[2] Japanese Government resale price of U.S. Western White No. 2 wheat, 1975/76 *(12)*.

[3] Price of U.S. Western White No. 2 wheat, including cost and freight to Japan, 1975/76 *(7)*.

[4] Japanese Government resale price of domestic rice, brown basis, average of grades 1-4, 1975/76 *(11)*.

[5] Weighted average of California short grain rice export price (f.o.b., plus freight between California and Tokyo) and Thai medium grain (10 percent broken, glutinous) rice export price (f.o.b., plus freight between Bangkok and Tokyo), 1975 *(8, 16)*.

[6] Japanese import unit value, c.i.f., of Chinese soybeans for food use, 1975 *(13)*.

[7] Japanese Government resale price of domestic barley, grade 2, 1975/76 *(11)*.

[8] Japanese import unit value, c.i.f., from all sources, 1975 *(13)*.

[9] Retail price of fluid milk in Tokyo (47 yen per 200 milliliter bottle), 1975 *(14)*.

[10] Weighted average price of Danish and New Zealand finest salted butter, and New Zealand cheddar cheese on the London Provision Exchange *(6)*, and the export unit value, f.o.b., of whole dry milk, processed American cheese, and nonfat dry milk exported by the United States to Japan (to all destinations in the case of nonfat dry milk) *(17)*; converted to a producer price by applying a 38-percent margin (farm ÷ wholesale = 0.38); converted to milk-equivalent prices and weighted by domestic production to give a world farm price where fulid milk is produced domestically at existing prices and processed milk products are imported at free world prices; 1975/76.

[11] Same weighted price as in [10] above; converted to a retail price by applying a 70-percent margin (retail ÷ wholesale = 1.7); converted to a milk-equivalent basis, weighted by their respective share of dairy product consumption, and averaged; 1975/76.

[12] Retail price of pork in Tokyo, 1975 *(14)*.

[13] Japanese import unit value, c.i.f., of U.S. pork *(13)*, adjusted for the spread between farm and wholesale prices in Japan (farm ÷ wholesale = 0.48), 1975.

[14] Japanese import unit value, c.i.f., of U.S. pork *(13)*, adjusted for the spread between wholesale and retail pork prices in Japan (retail ÷ wholesale = 1.53), 1975.

[15] Retail price of chicken in Tokyo, 1975 *(14)*.

[16] Japanese import unit value, c.i.f., of U.S. chicken *(13)*, adjusted for the spread between farm and wholesale prices in Japan (farm ÷ wholesale = 0.82), 1975.

[17] Japanese import unit value, c.i.f., of U.S. chicken *(13)*, adjusted for the spread between wholesale and retail poultry prices in Japan (retail ÷ wholesale = 2.0), 1975.

[18] Retail price of beef in Tokyo, 1975 *(14)*.

[19] Average of Smithfield price of chilled Argentine beef cattle hind quarters 1975/76 *(6)*, and the Japanese import unit value, c.i.f., of U.S. beef, 1975 *(13)*, adjusted for the spread between farm and wholesale prices in Japan (farm ÷ wholesale = 0.55).

[20] Average price in [19] above adjusted for the spread between wholesale and retail beef prices in Japan (retail ÷ wholesale = 1.62).

Table 4 – Net social loss incurred in consumption and production

Commodity	(1) NSL_c (1975/76)	(2) NSL_p (1975/76)	(3) NSL'_p (1985/86)	(4) (3) - (2) NSL_p (marginal)	(5) (1) + (2) *NSL* (total) (1975/76)	(6) (1) + (3) *NSL* (total) (1985/86)
			Billion yen			
Wheat	0.496	0	25.552	25.552	0.496	26.048
Rice	9.292	16.505	0	-16.505	25.797	9.292
Soybeans	0.415	0.332	248.916	248.584	0.747	249.331
Barley	1.672	3.179	97.873	94.694	4.851	99.545
Milk	31.652	10.319	176.830	166.511	41.971	208.482
Pork	26.345	1.156	1,119.604	1,118.448	27.501	1,145.949
Chicken	1.004	0.049	359.134	259.085	1.053	260.138
Beef	12.623	1.880	366.442	364.562	14.503	379.065
Total	83.499	33.420	2,294.351	2,260.947	116.919	2,377.850
			Million dollars			
Total	276	111	7,597	7,486	387	7,873

Wheat

The net social loss associated with wheat consumption and production is incurred because of the Japanese Government's monopoly role as sole buyer and seller of food grains. The Government purchases wheat from domestic producers for approximately twice the price that it pays for imported wheat. The resale price of domestic and imported wheat (to millers) has typically been at least 50 percent above the world price, resulting in revenue for the Japanese Treasury. However, with higher world grain prices in the early to mid-1970's, the Government maintained the resale price of wheat at previous levels to curb inflation, and in so doing subsidized wheat consumption. This occurred in 1975/76, and gives rise to the net social loss in consumption because the subsidy exceeded the increase in consumer surplus.

Wheat consumption has increased dramatically in Japan since World War II, mainly as a result of the trend toward a bread-based Western diet. Per capita wheat consumption rose from 41 kilograms in 1955/56 to 50 kilograms in 1975/76. In Japan, wheat is largely a second crop taken from land used to grow rice over the summer. In recent years, wheat production has fallen markedly despite increasing farm prices for wheat. We offer two possible reasons for this occurrence. First, most farmers are part-time and prefer to plant only one crop per year in order to maintain their off-farm employment. This being the case, the traditional rice crop is preferred. Second, new high-yielding rice varieties are planted earlier and tend to take longer to mature than the old varieties. This cuts into the growing season for wheat, in some cases allowing insufficient time for a wheat crop to mature.

Rice

The cornerstone of Japan's food policy is continued production and consumption of rice at current total levels. In 1975/76, support prices paid by the Government to farmers were more than twice the level of prices of equivalent rice in world markets. To maintain consumption, a subsidy is paid on rice. Even so, the domestic retail rice price is above the price at which imported rice could be sold. The effects of these market distortions produce a net social loss in rice production and consumption.

Rice is the traditional staple in Japan, but per capita consumption declined from 126 kilograms in 1955/56 to 107 kilograms in 1975/76, on a brown (husked) basis. Rice production is highly intensive and planted area usually covers over 2.7 million hectares of flat land. Production has remained at around 12 million tons (brown basis) in recent years and yields are high – 4.81 tons per hectare of irrigated paddy field rice in 1975/76. Rice is by far the most dominant field crop. In 1975/76, area planted to rice exceeded the area to wheat and barley combined by a factor of 16. While arable land is always a constraint to increased production in Japan, a rice-breeding program has raised yields and by 1985/86, yields are predicted to be 4.85 tons per hectare. Therefore, less land than is now being used would be required to produce the estimated quantity demanded for domestic consumption in 1985/86. Because of increasing rice productivity and high support prices, the Government has found it necessary since 1971 to implement a production quota and a "rice area diversion program" in order to restrain production.

Soybeans

Soybeans grown in Japan are used in food products. Soybeans for crushing are imported free of trade restrictions, and as such do not cause a social cost. Processors of soybeans for food use purchase all domestic soybeans under Government administrative guidance. Domestic production currently supplies 21 percent of the demand for soybeans for food use; the balance comes from China and the United States. By 1985/86, plans call for increasing the level of domestic production to 60 percent of quantity demanded. Domestic soybean production is encouraged by incentive payments which raise producer prices above world levels, thus giving rise to a net welfare loss. Wholesale and retail soybean prices are not subsidized. Japanese consumers pay a price that represents the farm price of soybeans plus associated marketing margins and processing costs. The social loss in consumption arises from the divergence between world and domestic soybean prices.

Soy sauce, bean paste, bean curd, and numerous other food products important in the Japanese diet account for the country's use of soybeans in food. Consumption rose from 4.9 kilograms per capita in 1955/56 to 6.2 kilograms in 1975/76, or a total of 637,000 tons in 1975/76. Despite increasing real farm prices for soybeans, production has declined markedly over the last 20 years. In 1955/56, production was almost 507,000 tons, while by 1975/76 it had fallen to 126,000 tons.

Barley

The net welfare loss induced by barley consumption and production comes about because of farm support prices equivalent to more than twice world barley prices. As with wheat, the Government imports and resells barley, usually at a small profit over the buying price, although the opposite occurred during 1975/76, when world barley prices were high. Domestic production is small – 10 percent of 1975/76 consumption – but the 1985/86 agricultural plan calls for raising barley production to over one-third of consumption needs. This is to be achieved mainly by double-cropping on rice paddies, which is being encouraged by higher support prices and incentive payments for double-cropping.

We exclude from our analysis of barley consumption that portion which is used as feed. Consumption as food (excluding malting) declined rapidly between 1955/56 and 1975/76, but consumption for beer increased steadily. Like wheat, barley is largely produced on double-cropped paddy land following the rice harvest. Despite increases in barley support prices and incentive payments to encourage double-cropping, the current trend of nonagricultural employment of farm labor during the off-season (for rice) has limited the effectiveness of these incentives to bring forth further production.

Dairy Products

Japan's relatively high-cost dairy production is maintained by trade barriers and support prices which put Japan's dairy industry among the most heavily protected in the world. Import restrictions on dairy products in the form of quantitative restrictions and duties give rise to consumer prices that are considerably higher than in many other developed countries. Milk producers

receive input subsidies for pasture improvement, plus a guaranteed milk price which is approximately 50 percent higher than that received by U.S. producers.

With the dramatic economic growth rate in Japan over the post-World War II years and the trend toward a higher protein diet, per capita consumption of dairy products increased more than fourfold between 1955/56 and 1975/76 – from 13 to 55 kilograms (raw milk equivalent). Along with dairy product consumption, milk production has developed greatly in recent years with the introduction of exotic breeds of cows and the development of high-elevation pastures. From 1 million tons in 1955/56, milk production has grown to 5 million tons currently. Production has been stimulated by deficiency payments equal to the difference between the guaranteed producer price and the wholesale price, and by subsidies to farmers for pasture development in the highlands.

Pork

Pork imports are controlled by an intermittent variable import duty. Producer prices are guaranteed to be above some minimum controlled by Government purchases and sales in the wholesale market. The protection afforded the swine industry results in a distortion between world and domestic pork prices.

As with consumption of other meats and proteins, per capita pork consumption in Japan has increased significantly in the post-World War II era – from 0.96 kilograms in 1955/56 to 9.45 kilograms in 1975/76. Over this period, real pork prices increased but not sufficiently to offset the effect of rising income and changing tastes in pork consumption. Pork production in Japan increased from 86,000 tons in 1955/56 to 891,000 in 1975/76. With the inducement of rapidly rising real prices for pork, swine producing facilities and breeds have become modern and technically efficient.

Chicken

Although Japan's broiler industry is relatively efficient with virtually all production taking place in capital-intensive broiler facilities, retail chicken prices exceed world levels and result in a net welfare loss in consumption. Broiler producers actually received less than the world price in 1975/76, giving a net welfare loss from chicken production in that year.

Per capita chicken consumption rose from 0.4 kilograms in 1955/56 to 7.0 kilograms 1975/76, while real retail prices fell. Broiler production increased 23-fold over the 1955/56-1975/76 period and was 756,000 tons in 1975/76. Real producer prices increased over this period.

Beef

In 1975/76, domestic beef prices in Japan were higher than world prices because of the high degree of protection of a relatively inefficient industry. A net social loss in consumption and production has been generated by these price distortions.

The quantity of beef demanded by Japanese consumers did not increase as spectacularly over the 1955/56-1975/76 period as did that for pork and chicken. Annual per capita beef consumption increased from 1.5 kilograms to

3.6 kilograms, while real retail prices more than doubled. Because most beef cattle in Japan have historically been raised by extensive grazing methods rather than in feedlots, and since pasture is limited, beef production has not increased as much as has pork and chicken production. Beef production increased from 134,000 tons in 1955/56 to 327,000 tons in 1975/76, but the beef cattle inventory actually declined, and two-thirds of beef output currently comes from culled dairy animals.

CONCLUSIONS

The Japanese Government published consumption estimates for 1985/86, along with production goals, in order to calculate ratios of production to consumption by commodity. These ratios are referred to as "self-sufficiency" ratios in the Government's report *(10)*. We have avoided using this term because of its ambiguity with respect to the implicit role of trade barriers and administered prices. The Japanese Government's consumption estimates (see table 1) were based on no change in real terms in the 1972/73 domestic prices, a 5-percent annual real growth rate in per capita income, and a 1.1-percent annual population growth rate between 1972/73 and 1985/86. The income elasticities implicit in the Japanese Government's consumption estimates are compared with our calculations in the tabulation below:

	Japanese Ministry of Agriculture	Bale/Greenshields
Wheat	0.08	0.19
Rice	0.01	-0.31
Soybeans (excl. use for crushing)	0.12	0.23
Barley (excl. use for feed)	0.14	0.09
Dairy products	0.37	0.64
Pork	0.44	0.92
Chicken	0.32	1.33
Beef	0.61	0.62

The major differences occur in the elasticities for chicken and pork, and are attributed to the fact that the Japanese calculations were made from household consumption data, which exclude meals prepared outside of households. Apparently, as much as 40 percent of meat consumption in Japan is accounted for by away-from-home meals *(15)*. Our calculations are made from data on total consumption.

Using the same assumptions about price, per capita income, and population as contained in the Japanese study, we have calculated estimated consumption in 1985/86. These calculations are displayed in table 5, and are compared with the Japanese estimates. Our estimates are larger except for rice and barley.

It is assumed that Japan's production goals will remain the same as currently outlined (that is, they will not be raised in light of the higher consumption estimates calculated in this study). If so, imports will be greater by the amount of difference between our consumption estimates and those of the Japanese Government. These comparisons are also shown in table 5. Significant differences occur in dairy products, chicken, and pork.

Table 5 – Comparison of consumption estimates and implied imports, 1985/86

Commodity	Consumption		Imports[1]	
	MAF[2]	B/G[3]	MAF[2]	B/G[3]
	1,000 metric tons			
Wheat	5,899	6,581	5,346	6,028
Rice[4]	12,110	7,620	0	(-4,490)
Soybeans	[5]707	[5]790	4,580	4,663
Barley	[6]996	[6]947	1,612	1,563
Dairy products	8,142	9,985	462	2,305
Pork	1,335	1,825	10	500
Chicken	915	1,664	1	750
Beef	625	630	117	122

[1]Inferred from production goals and consumption estimates assuming no change in stocks and no exports. A rice surplus of 4,490,000 tons emerges in our column, however, which we denote as negative imports = exports.

[2]Ministry of Agriculture and Forestry *(10)*.

[3]Based on demand equations reported in this study. The projections using our equations are based on the Japanese assumptions about price, income, and population changes, and therefore are not official U.S. Department of Agriculture projections.

[4]Brown basis.

[5]Exculding soybeans for crushing.

[6]Excluding barley for feed.

Another and more likely policy option for the Japanese would be to raise the production goals to levels that result in the same ratios of domestic production to consumption as those that are indicated in the existing goals for 1985/86. The welfare cost of that option can be calculated, as we have done in this study for the existing goals. The additional social cost would be substantial. Also, higher livestock production would necessitate increased imports of feed (including soybeans for crushing and barley for feed).

The supply analysis reveals that there is a production response to price incentives, ranging from 1.61 for wheat to 0.12 for chicken, but we have not otherwise surveyed the production goals to check their attainability.[11] It is clear, however, that if producer prices increase sufficiently in real terms, the planned output for 1985/86 will be forthcoming. For crops, because of the possibility of double-cropping, land will not be an immediate constraint to

[11]For an excellent analysis of their attainability, see Sanderson *(15)*.

production. Likewise, given sufficient imports of inputs, land will not restrict dairy or meat production. Some technical problems such as waste disposal will become more important as livestock production increases, but this will merely increase the output price required to bring forth the higher levels of production.

The calculated net welfare losses are not simply transfer payments to agriculture from other sectors of the economy. Rather, the losses represent a real reduction in national income. If the 1985/86 production goals had been implemented in 1975/76, the total net social losses would have been equivalent to 2 percent of Japan's GNP, or one-third of each household's expenditures on the eight commodities or their products.

Government policies which interfere with the free interplay of market forces are a common feature of modern economic life. Such policies are often imposed for political, social, or economic reasons on the assumption that the benefits derived from them exceed their economic consequences. In Japan, there are some benefits to be gained from maintaining and possibly increasing agricultural production. Among those frequently cited are ones pertaining to food security – the possible interdiction of trade because of war, a rise in the real world price of food commodities, agricultural price instability, and oligopolistic behavior of agricultural exporters *(15)*. Without information on the national cost of various levels of domestic production, however, it is impossible for policy makers to make informed decisions on the advisability of a given level of production. This report has presented calculations on the social cost of achieving two levels of Japanese agricultural production by Government price intervention. The cost estimates should facilitate an enlightened debate on whether Japan's agricultural production goals do or do not have a favorable social benefit/cost ratio.

REFERENCES

1. Bank of Japan
Prices Indexes Annual, Tokyo, various issues.

2. Corden, W.M.
"The Calculation of the Cost of Protection," *Economic Record*, Mar. 1957. pp. 129-148.

3. Currie, J.M., J.A. Martin, and A. Schmitz
"The Concept of Economic Surplus and its Use in Economic Analysis," *Economic Journal*, Dec. 1971, pp. 741-799.

4. Dardis, R., and E.W. Learn
Measures of the Degree and Cost of Economic Protection of Agriculture in Selected Countries, Technical Bulletin No. 1384, U.S. Dept. of Agr., Nov. 1967.

5. Economic Planning Agency
Annual Report on National Income Statistics, Tokyo, various issues.

6. Food and Agriculture Organization of the United Nations
Monthly Bulletin of Agricultural Economics and Statistics, Rome, various issues.

7. International Wheat Council
World Wheat Statistics, London, various issues.

8. Maritime Research Inc.
Charter Fixtures Report in New York and London, New York, various weekly issues.

9. Ministry of Agriculture and Forestry
Food Balance Sheet, Tokyo, various annual issues.

10. _____
Long-Term Prospect of Production and Demand of Agricultural Products in Japan, Tokyo, Aug. 1975.

11. _____
Statistical Yearbook of the Ministry of Agriculture and Forestry, Tokyo, various issues.

12. _____
Unpublished data from the Food Agency, Tokyo.

13. Ministry of Finance
Japan Exports and Imports, Tokyo, Dec. 1975.

14. *Office of the Prime Minister*
Monthly Statistics of Japan, Tokyo, various issues.

15. Sanderson, F.H.
Japan's Food Prospects and Policies and Their Impact on U.S.-Japanese Relations, The Brookings Institution, manuscript, Feb. 11, 1977.

16. U.S. Dept. of Agriculture
Rice Marketing News, various issues.

17. _____
U.S. Foreign Agricultural Trade Statistical Report, Fiscal Year 1976, Sept. 1976.

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